



High-Impact Cancer Game for Science Education

Grant Number: R44CA094469-03

Abbreviated Abstract

This project is producing a video game that integrates compelling computer gaming with constructive learning. The video game is an action game located in and around cells in the human body. The player learns about cell biology while outmaneuvering and overcoming numerous obstacles and ultimately repairing damage caused by carcinogens from tobacco smoke. The game is designed to be as entertaining and engaging as commercial computer games; however, in “beating the game” the player learns basic and advanced concepts of cell biology and cancer. The game content aligns with National Science Education Standards. The project design team includes cancer researchers, science education specialists, classroom teachers and game development specialists. Three middle school student advisory panels helped guide the game design. In prototype testing, 100% of the middle school volunteers reported they enjoyed the game and would like to play it on their own time at home. Seventh graders improved their scores on pre-post tests by 41%. All of the classroom teachers reported that they could use the game effectively to improve instruction in their classrooms. Phase II will complete the remaining levels of the game and develop a methodology that can be reused to create other compelling learning games.

Primary Investigator

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Bryan Rickertsen has a Ph.D. in philosophy (specializing in logic and philosophy of language) and a M.S. in Electrical Engineering (specializing in computer science). Bryan has held positions as Head of the Department of Philosophy at Tuskegee Institute, Head of Information Systems at the Lincoln Telephone Company, Vice President Technology at Aliant Communications, and Senior Vice President Network Engineering at Alltel Communications. He is currently President of CommGraphics Interactive, a software, multimedia, and video game company.



Research Team & Affiliations

Learning Team: Ron Bonnstetter, Ph.D., University of Nebraska—Lincoln;

Kirsten Smith, M.S., Lincoln Public Schools; Marleen Rickertsen, M.S., CommGraphics Interactive

Medical Advisor: Ralph Hauke, M.D.

Game Team: Chad Gleason - Producer/Director/Animator, CommGraphics Interactive; Chris Holden -

Designer/Environment Artist, , CommGraphics Interactive; Douglas Shuler - Concept Artist,

Consultant; Jon Jones - Character Artist, Consultant; Barry Collins - Texture Artist, Consultant; Brian

Jones - Texture Artist, Consultant; Kochun Hu - Sound, Consultant

Andrew Weldon - Writer, Consultant

Project Management Team: Bryan Rickertsen, Ph.D. – P.I. and Executive Producer, CommGraphics

Interactive; Neil Wineman, B.S. - Project Manager, CommGraphics Interactive; Jo Gutsell - Grant

Manager, CommGraphics Interactive; Diane Giebelhaus - Project Support, CommGraphics Interactive

Total Budget

\$849,667.00

Research Objectives

Aim 1: Complete development of the video game—First 18 months of Phase II, April 1, 2004-September 30, 2005.

Aim 2: Determine its effectiveness—Final 6 months of Phase II, October 1, 2005-March 31, 2006.

Theory/Hypothesis

We hypothesized that a real video game would provide an effective platform for educating youth about the science underlying cancer if it created an interesting model of the cell and subcellular entities, allowed youth to virtually enter and act inside the cell world, and presented scientific information in real terms, while providing a video game experience comparable the that provided by commercial successful video games intended purely for entertainment.

Experimental Design

Approximately 200 middle school youth will participate in the evaluation. Students will complete a pretest, play the entire video game over several sessions (total of 4-8 hours), complete a posttest, and complete a social acceptability questionnaire.

Final Sample Size & Study Demographics

200 Middle school and 9th grade youth in Lincoln, Omaha and Papilion, Nebraska.

Data Collection Methods

Survey questionnaire and pre-post testing.



Outcome Measures

Knowledge improvement from pre to post; social acceptability of game compared to other video games participants play for entertainment.

Evaluation Methods

Statistical analysis of questionnaire and pre-post test results.

Research Results

Two full product evaluations were performed. In the first, subjects played the game purely for entertainment. In the second, the game was used as in the biology curriculum and the post test was used as the final exam for the unit. The two full product evaluations are described below:

Nano Legends™ Test Results: Game Played Purely for Entertainment

Participants: 109 Middle School Students from Lincoln Lutheran, MARR (Omaha), and Omaha Boys and Girls Clubs

Approach: Students played Nano Legends™ one time for entertainment. Post-Test results were not included in students' grades.

<u>Test Scores:</u>	Pre-Test Average	Post-Test Average	Percent Improvement
Raw Scores	40%	56%	40%
Guess Corrected	20%	41%	105%

Survey Opinions:

How does Nano Legends™ compare to other video games you play?

Just as Good or Better	Almost as Good	Not Close
71%	20%	9%

How likely would you be to play Nano Legends™ on your own time?

Highly Likely	Somewhat Likely	Not Very Likely	Not at all Likely
38%	51%	6%	5%

How likely would you be to recommend Nano Legends™ to a friend?

Highly Likely	Somewhat Likely	Not Very Likely	Not at all Likely
35%	57%	5%	3%

Visit the SBIR Product Directory online at <http://cancercontrol.cancer.gov/hcirb/sbir>



Nano Legends™ Test Results: Nano Legends™ Used in Biology Class

Participants: 116 9th Grade Students from Papillion-LaVista South High School

Approach: Nano Legends™ was used as biology curriculum in five classes. Students played Nano Legends™ and participated in various supplemental learning activities selected from the Teacher's Guide. The Post-Test was used as final exam for the unit.

<u>Test Scores:</u>	Pre-Test Average	Post-Test Average	Percent Improvement
Raw Scores	49%	84%	72%
Guess Corrected	31%	78%	148%

Survey Opinions:

How does Nano Legends™ compare to other video games you play?

Just as Good or Better 64%	Almost as Good 29%	Not Close 7%
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How likely would you be to play Nano Legends™ on your own time?

Highly Likely 28%	Somewhat Likely 43%	Not Very Likely 22%	Not at all Likely 7%
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How likely would you be to recommend Nano Legends™ to a friend?

Highly Likely 39%	Somewhat Likely 43%	Not Very Likely 17%	Not at all Likely 1%
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Barriers & Solutions

Product(s) Developed from This Research

Working name: Nano Legends™